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Institut de recherche sur les feuillus nordiques Inc.
Northern Hardwoods Research Institute Inc.

Effects of Stand Competition on Tree Characteristics and Wood Quality of Sugar Maple

September 2015

Technical Note

Resource Characterization

Introduction

Higher quality sugar maple wood is generally obtained from the section of stem below the first large branch. To produce a veneer quality log, a sugar maple tree must have very little sweep and a high proportion of white coloured, or so-called, clear wood. Accordingly, dark coloured wood (discoloured wood) strongly reduces log values when present. A higher proportion per volume of clear wood generally increases growth and improves wood quality on uneven-aged hardwood stands. In every cutting cycle, mature and poor-quality trees are selectively harvested to promote growth and wood quality of residual trees. A wider gap is beneficial to have better growth. However, branch-free bole length of younger trees is reduced in larger canopy gaps. Formed when a big branch is attached to the lower part of the stem, a fork at lower bole height shortens the length of high quality log as stem section above the fork is often curvy. Natural pruning can be stimulated by maintaining denser stands to increase branch-free bole length. However, bole injuries that are induced by branch mortality are likely to reduce the proportion of clear wood. Stand density, on one hand, increases bole length. On the other hand, it reduces vigour and clear wood proportions. In that context, this study explores how important wood quality attributes of sugar maple can be augmented through stand density management.

Highlights

- *The height of the first significant fork influences bole length and stem taper.*
- *Younger trees need to grow in denser stands to gain longer branch- free boles, providing more clear wood volume from a tree of a given diameter.*
- *Competition should then be reduced when desired bole length is achieved to prevent future tree injuries that may reduce its value.*

Methodology

This study uses a destructive sample of 109 sugar maple trees coming from three different locations (Mont-Laurier, Duchesnay and Biencourt) of southeast Quebec, Canada. At first, location and size of all competitors of the subject tree was measured. Once the tree was felled, tree crown and stem characteristics were measured. Wood disks at different heights from base to tree top were collected to compute stem, clear wood, and discoloured wood volumes. Tree age was

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determined by counting the number of annual growth rings present at breast height. Johann's competition Index (a distance dependent competition index) was used to quantify state of competition for each sample tree. This gathered information was used in statistical modeling to demonstrate effect of competition on tree crown and stem characteristics and thereby wood quality of sugar maple.

Results

1. Competition increases height to first live branch for a tree of a given age.

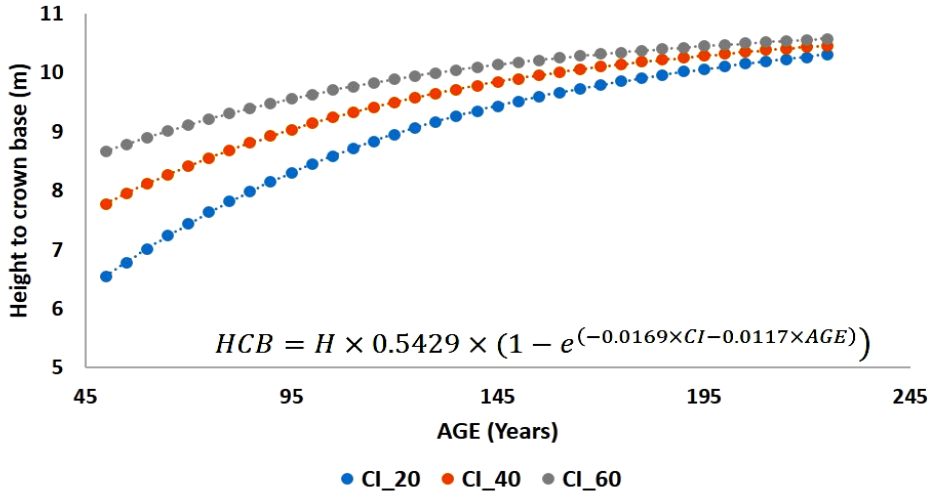

Figure 1: Height to first live branch of a 20 m tall tree with tree age at different level of competition. CI_20: Low competition, CI_40: Medium competition, CI_60: High competition

2. Height of the biggest branch (fork) influences stem tapering.

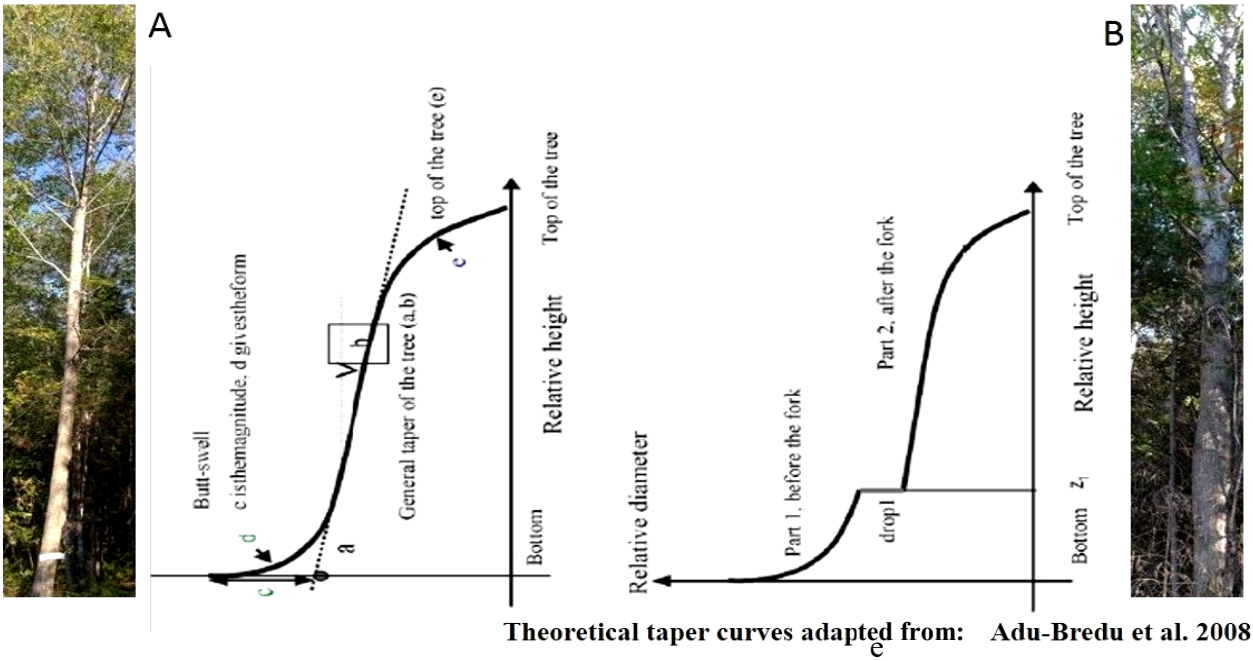

Figure 2: Effects of fork height (height to the biggest branch) on stem tapering. (A) non-forked and (B) Forked

3. Height of the biggest branch (fork) influences bole length and volume up to the merchantable height (24 cm top diameter).

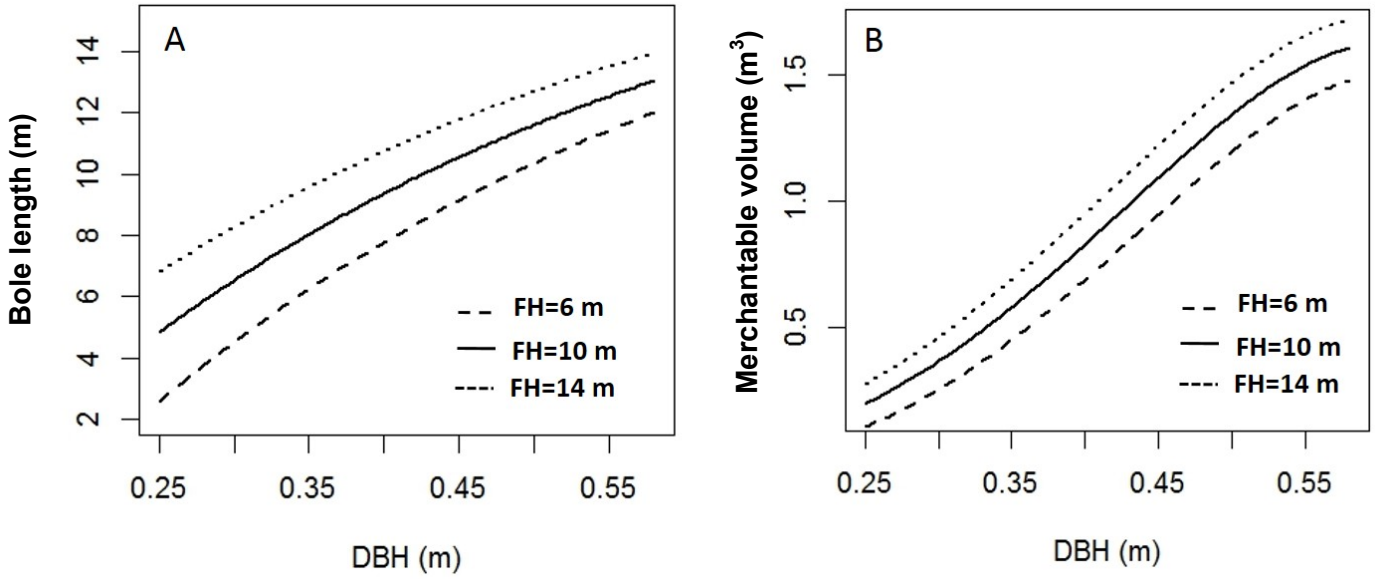

Figure 3: Effect of fork height (FH) on bole length (up to 24 cm top diameter) and merchantable volume for a given diameter tree.

4. Although clear wood proportion decline with competition, clear wood volume for a tree of a given diameter was found to increase with competition mostly due to increase in bole length.

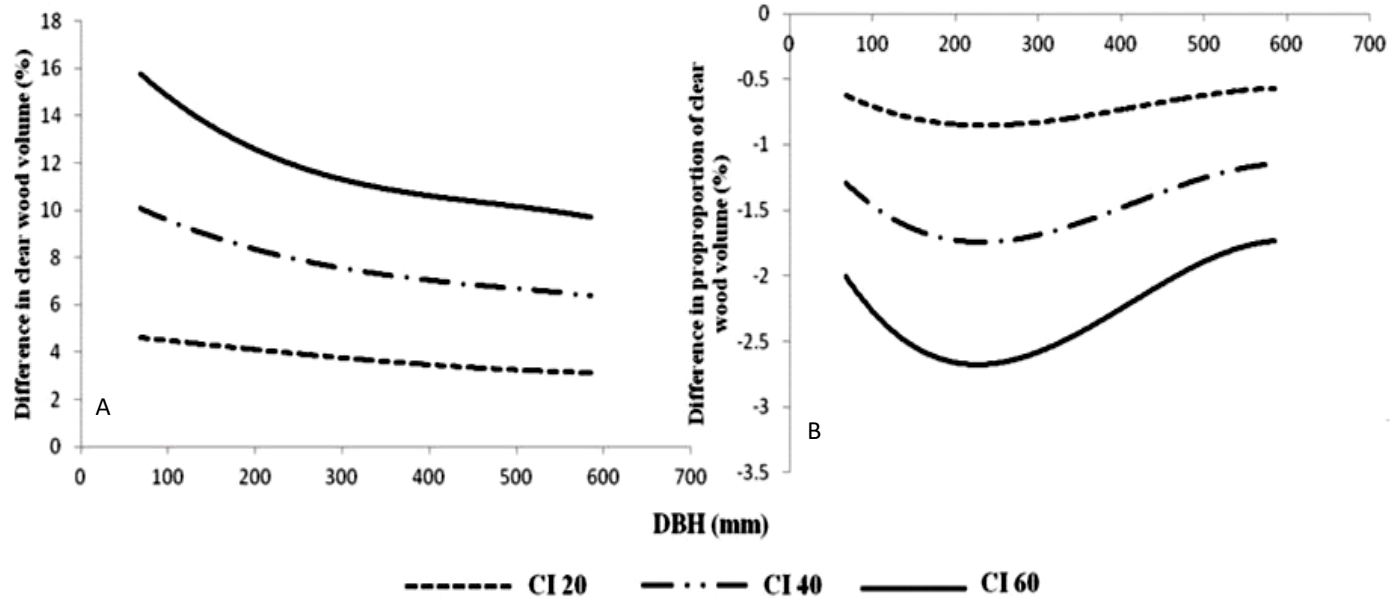

Figure 4: Effects of competition on (A) clear wood volume and (B) clear wood proportions. CI_20: Low competition, CI_40: Medium competition, CI_60: High competition

Conclusion

Trees that are growing in higher levels of competition have longer branch-free bole at a given age. Effects of competition on crown recession (natural pruning) is higher when trees are young (< 100 years). Fork height (or position of the biggest branch in the crown) influences stem tapering. As a result, low forked trees have shorter bole and less merchantable volume for a given diameter tree. Also, proportions of clear wood volume in trees in a higher competition stand are less than in a lower competition stand. The main reason for this effect is that trees in a higher competition stand possess more injuries related to branch death, which induces discolouration of the wood.

Therefore, clear wood volume in the merchantable part of the log is a trade-off between higher clear wood proportions, due to the bigger crown in lower levels of competition, and the length of merchantable log, which generally decreases with the bigger crown. Hence, sugar maple trees should grow in higher levels of competition when they are young so that they will have longer branch-free parts, and the stand should be thinned (or competition reduced) to let the crop trees grow with a vigorous crown.

References

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